An Overview of Fine Particles

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(EMAD)

For Presentation at October 2000

EIIP Workshop

Key PM2.5 Source Categories (National EI)

DIRECT EMISSIONS

Carbonaceous [a, b]

- ***Residential Wood Burning***
- ***Managed Burning***
- ***Non-Road Mobile***
- ***Wildfires***
- ***Residential Waste Burning***
- ***On Road Mobile***
- Power Gen Coal
- Boilers (Oil, Gas)
- Boilers (Wood)

Crustal / Metals [b]

- Fugitive Dust
- Mineral Prod Ind
- Ferrous Metals

PRECURSOR EMISSIONS

SOx [c]

- ***Power Gen (Coal)***
- ***Power Gen (Oil)***
- Boilers (Coal)
- Boilers (Oil)
- Pulp and Paper

NOx

- ***On Road Mobile (Gas, Diesel)***
- ***Non-Road Mobile (Diesel)***
- ***Power Gen (Coal)***
- ***Boilers (Gas)***
- Residential (Gas, Oil)
- Mineral Prod Ind

NH3

- ***Animal Husbandry***
- Fertilizer Application
- On Road and Non Road
- Wastewater Treatment
- Boilers

VOC [d]

- ***Biogenics***
- Solvent use
- On Road (Gas)
- Storage and Trans
- Residential Wood
- Petro Industry
- Waste Disposal

a Includes organic particles, elemental carbon and condensible organic particles
b Impact of carbonaceous emissions on ambient PM 5 to 10 times more than crustal emissions impact
c Includes SO_2, and SO_3 and H_2SO_4 condensible inorganics
d Contributes to formation of secondary organic aerosols

NOTE: Categories in ***BOLD ITALICS TYPE*** are most important.

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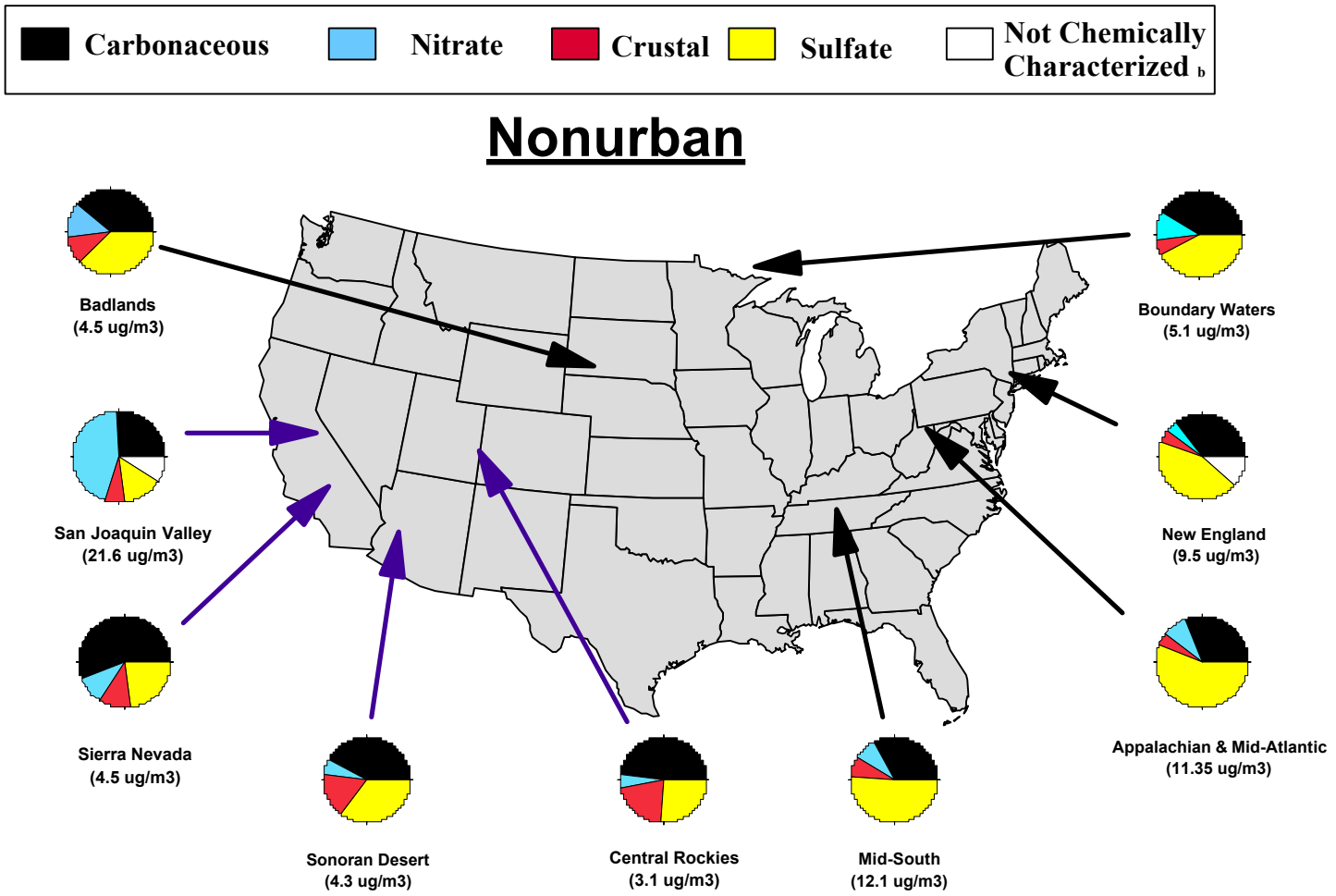
$PM_{2.5}$ Ambient Composition[a]



a. $PM_{2.5}$ mass concentrations are based on at least one year of monitoring at each location using a variety of non-Federal reference methods. They should not be used to determine compliance with the $PM_{2.5}$ NAAQS. Urban pies are based on 1 site per city or area unless otherwise noted. With exception of the Sierra Nevada and Badlands, nonurban pies represent an average of two or more sites located in the same region.

b. A white segment in a pie indicates that the sum of the constituents (as determined by separate analyses) was less than the gravimetrically determined mass concentration. This could be because study objectives did not require analysis of certain constituents (e.g., no carbon or nitrate analyses for the Tennessee sites) or a variety of technical reasons.

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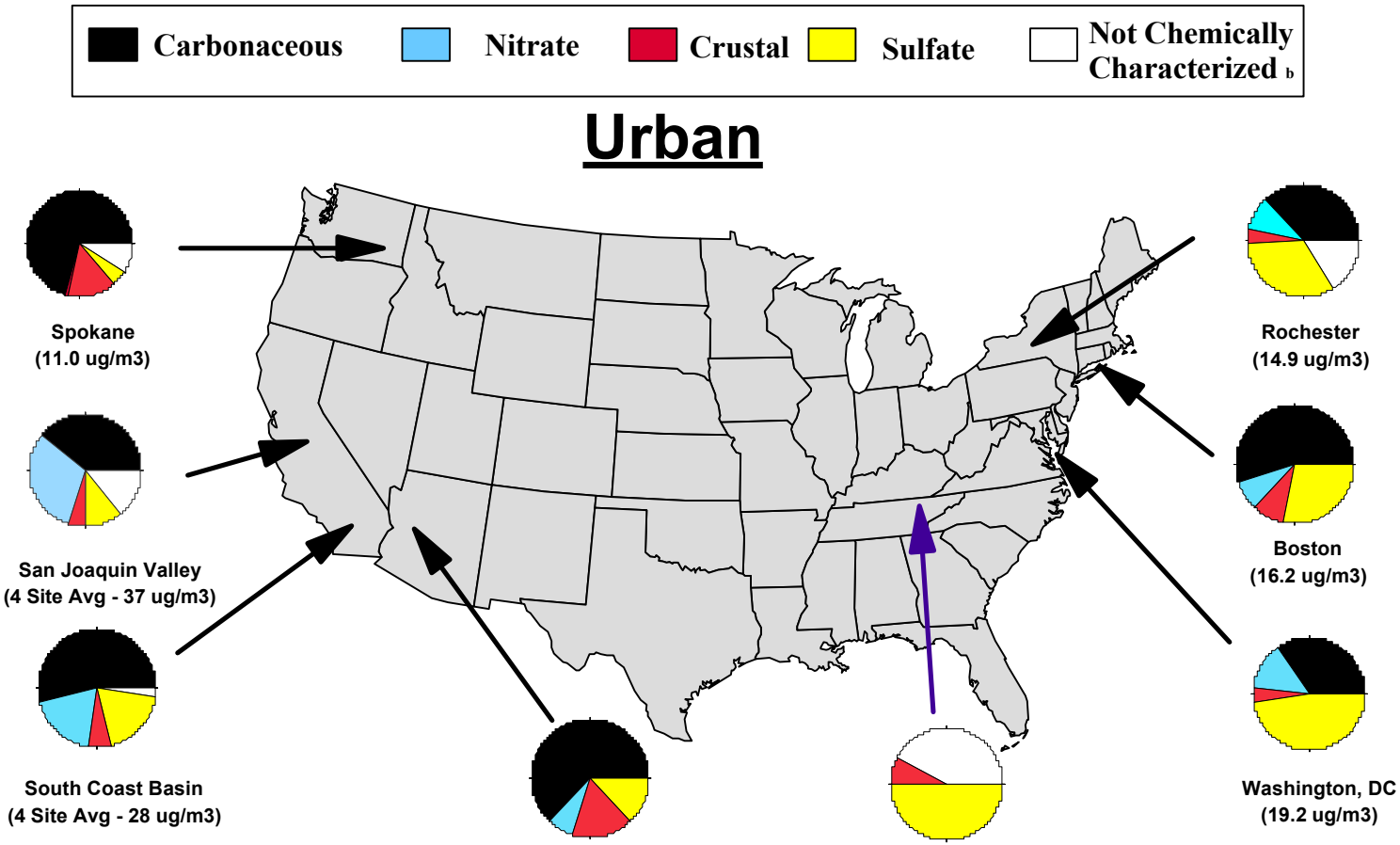

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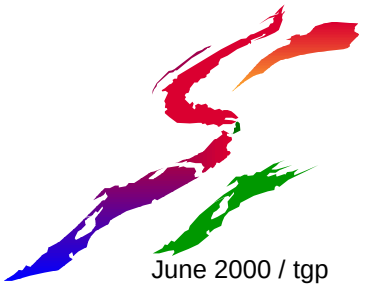
Crustal Materials Issues

Emission Issues

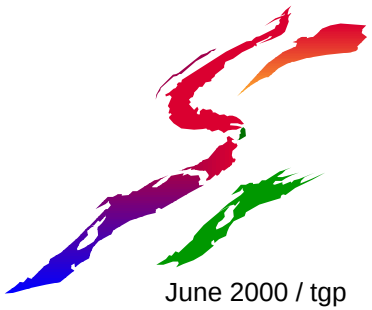
- EmissionsTesting Proximate to Source
- Particle Sizing Issues
- Effect of Moisture
- Default Silt Content
- Default Surface Loading
- Silt Content Measurements
- Surface Loading Measurements



Crustal (Continued)

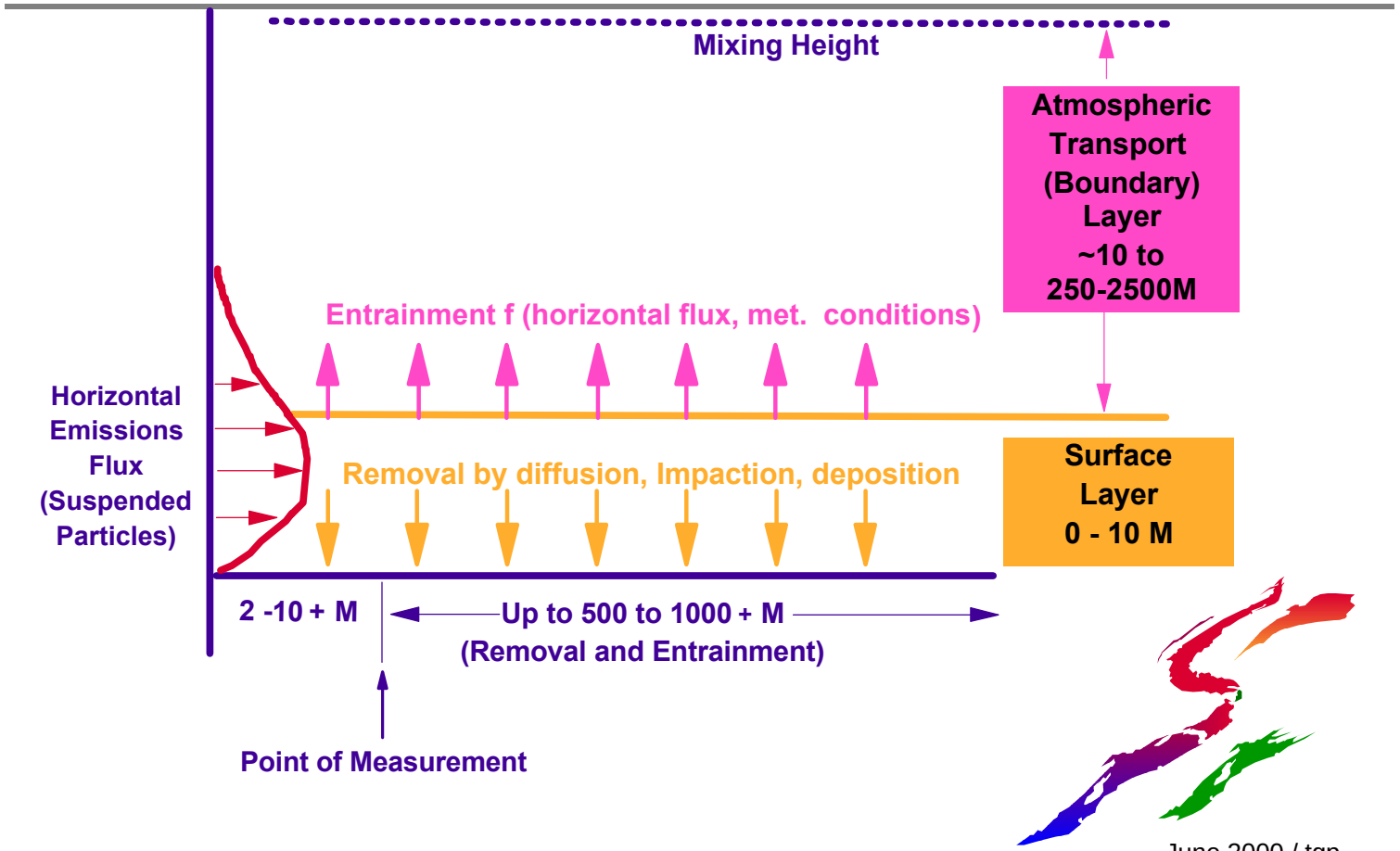
Transport and Removal Issues

- Spatial Distribution of Sources
- Area of influence
- Release Height
- Lack of Thermal Bouyancy
- Near Source Deposition/Removal
- Horizontal vs Vertical Flux



Crustal Emissions - Conceptual Model*

* Note: Applies to unpaved roads, paved roads, construction activities, etc., but NOT necessarily to wind erosion



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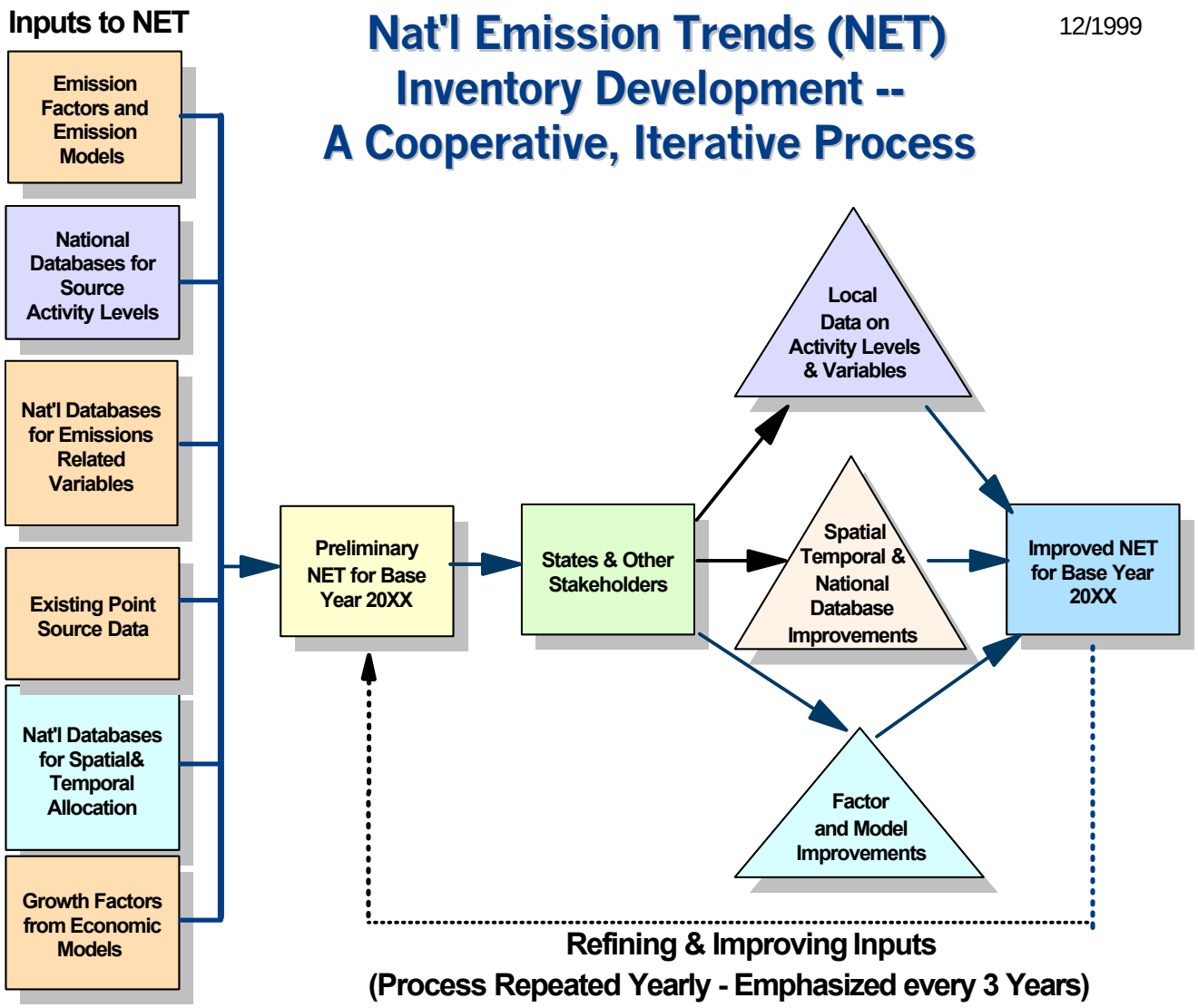
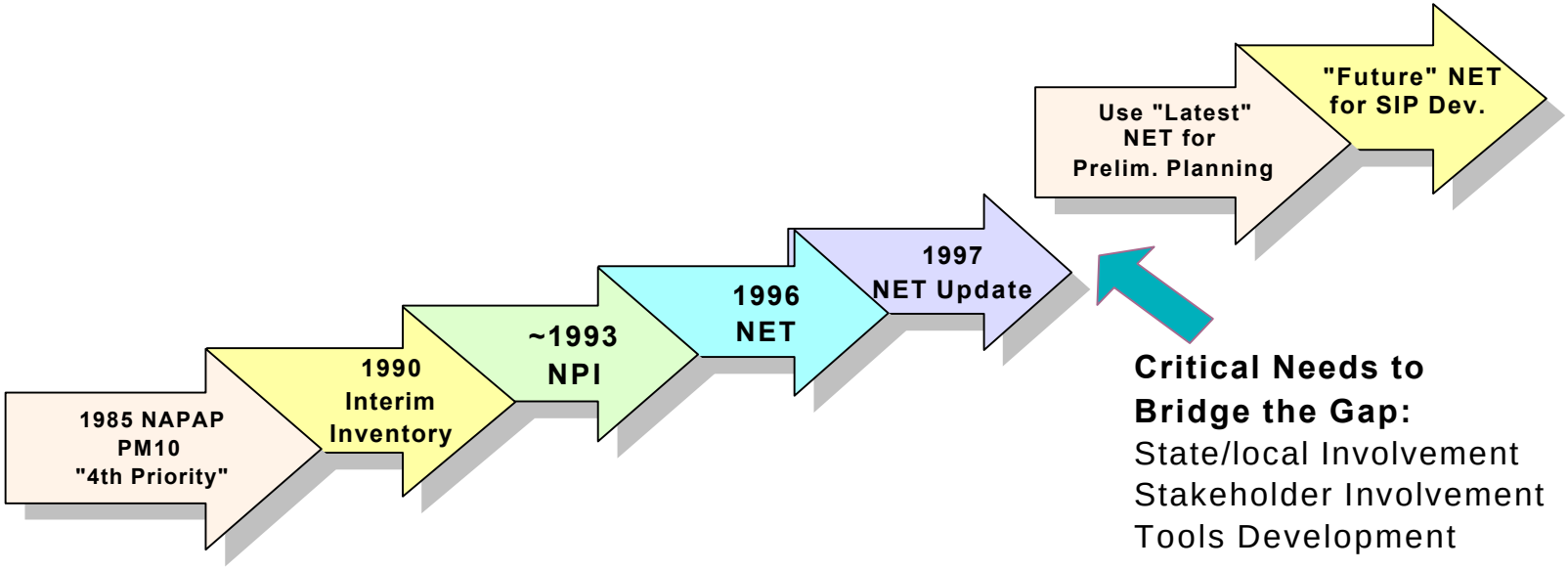
Nat'l Emission Trends (NET) Inventory Development -- A Cooperative, Iterative Process

12/1999



Evolution of the PM2.5 Emissions Inventory



Critical Needs to Bridge the Gap:
State/local Involvement
Stakeholder Involvement
Tools Development

NAPAP - National Acidic Precipitation Assessment Program
NPI- National Particulate Inventory
NET- National Emission Trends Inventory

Progress Report - PM Fugitive Dust EI Issues

Source Category	Emission Factor	Activity Data
Unpaved Roads	Reworking existing algorithm – Draft 9/00	States need to improve VMT
Construction	Reworking existing algorithm – Draft 9/00	EPA will apply new methodology for NEI
Ag Tilling	National appropriateness of algorithm questioned…	Need to develop, apply regional crop calendars
Paved Roads	Current algorithm cumbersome to use	Some simplification desirable.
Wind Erosion	WEPS Algorithm developed by USDA	Must test, compile input databases & apply model
Transport Fraction	Algorithm to estimate vertical / horizontal flux recently proposed	Must test algorithm & apply using surface roughness & wind data.

Progress Report - PM Combustion EI Issues

Source Category	Emission Factor	Activity Data
Managed Wildland Burns	Emission Factor under review by EPA/WRAP	Inventory needs under review by EPA/WRAP
Residential Wood Combustion	Work on performance deterioration nearly done	Extensive rework by EPA – Draft due 9/00
Wildfires	Emission Factor under review by EPA/WRAP	Inventory needs under review by EPA/WRAP
Residential Open Burning	Extensive methodologies work by EPA – Draft 9/00	Extensive methodologies work by EPA – Draft 9/00
Non Road Diesel	Draft model undergoing periodic revisions, due ’01	Draft model undergoing periodic revisions, due ‘01
PART Model	PART needs to be updated for exhaust & fugitives.	PART needs to be updated for exhaust & fugitives.

Specific PM Source Categories Most Needing Collaboration

- Unpaved Roads - Refine *VMT & Speed Data*
- Tilling Factors - *"Adopt" this Factor*
- Crop Calendars - *Develop,Apply*
- Wind Erosion - *Evaluate, Apply*
- Res. Open Burning - *Activity Data*
- Agri. Field Burning - *Activity Data*
- Res. Wood Combustion - *Improve as needed*

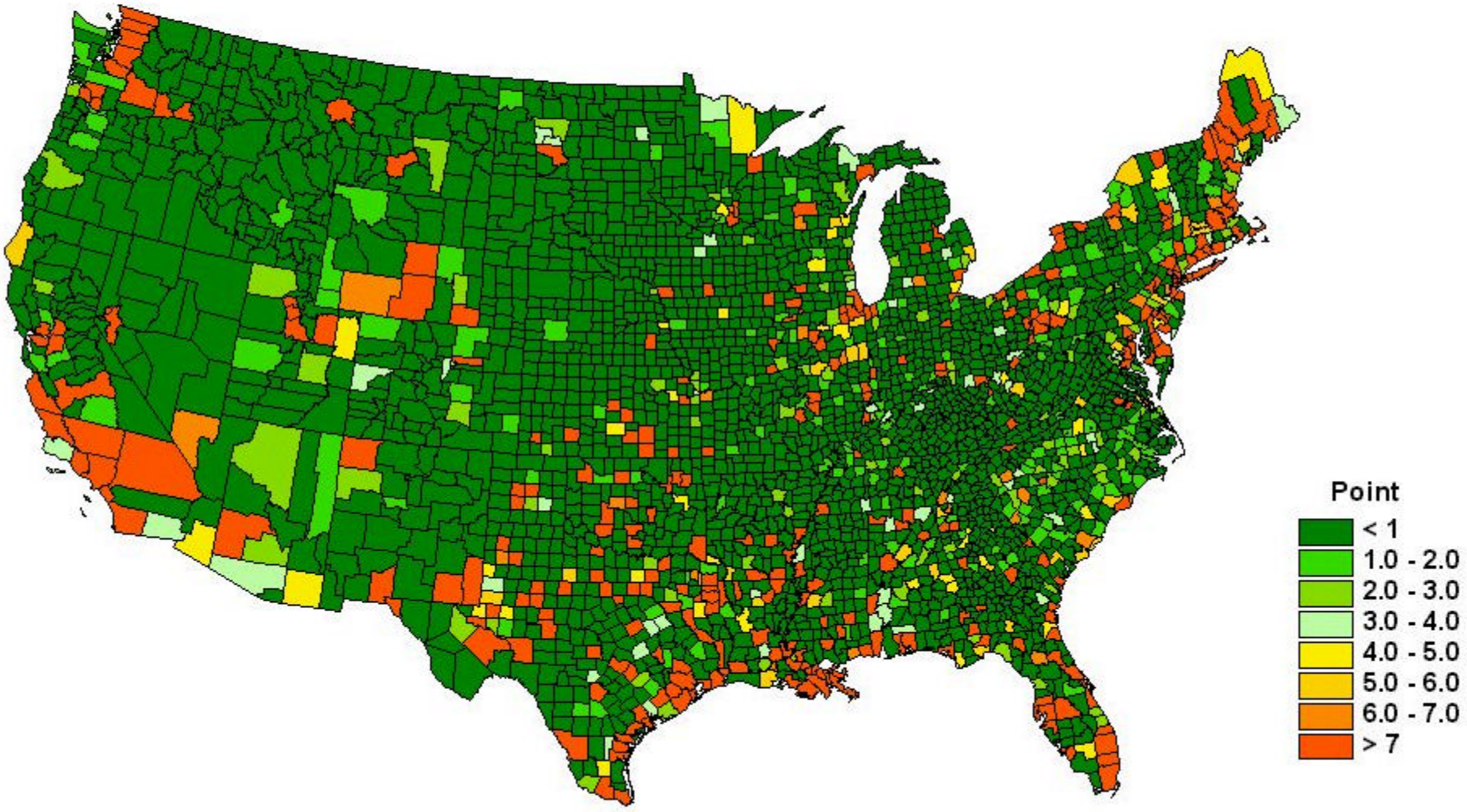
Improving Estimates of Ammonia Emissions into the Ambient Air
An Overview

Tom Pace
Emissions Monitoring & Analysis Division (EMAD)

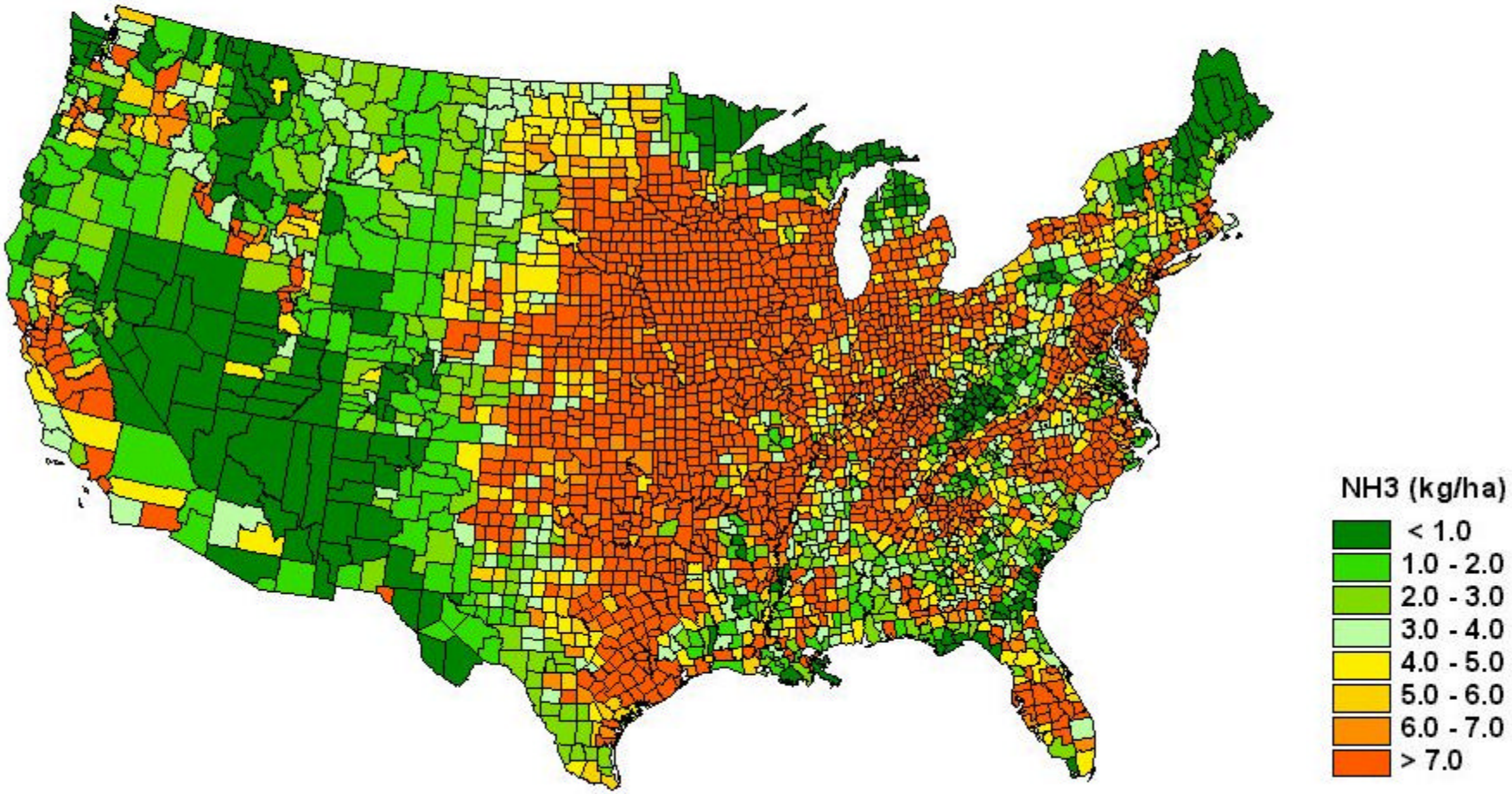
For Presentation in:

PM Emissions Inventory
Development Workshop

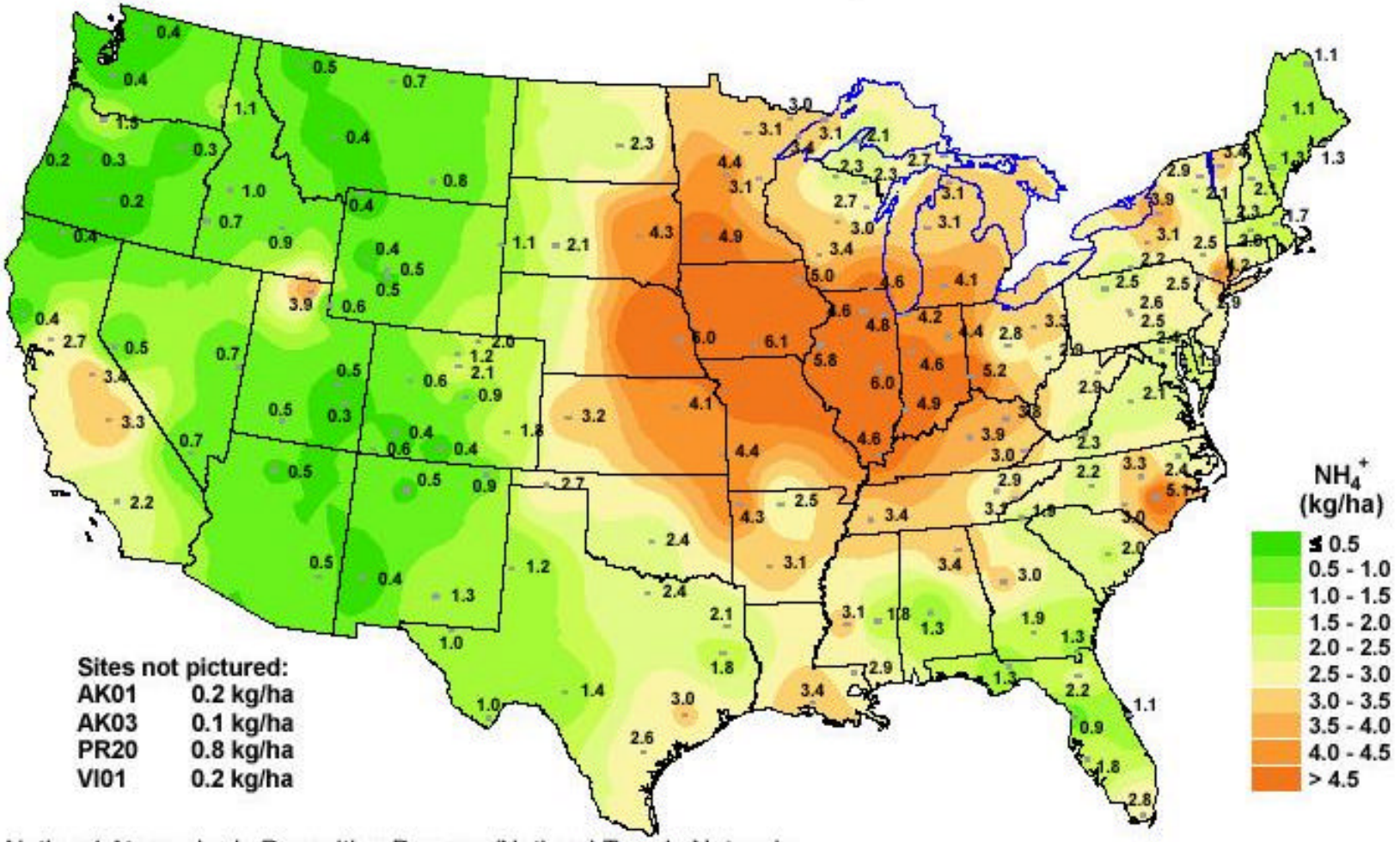
Estimated Ammonia Emissions-NET Inventory
Point Sources



Estimated Ammonia Emissions-NET Inventory



Estimated ammonium ion deposition, 1998



National Atmospheric Deposition Program/National Trends Network
http://nadp.sws.uiuc.edu

Ammonia Sources

- **Key categories in current EI**
  - Animal Husbandry (80%)
  - Fertilizer Application (10%)
  - Point Sources (may be large locally)
  - Mobile Sources ?
- **Missing Sources** (May not be major sources)
  - Humans, Domestic and wild animals
  - Open burning
- **Soils and Vegetation**
  - Can be source or sink
  - Work ongoing in TX and CA

Ammonia from Fertilizer Application

- **NET estimates based upon:**
  - European factors (Battye Report)
  - Activity data used is sales by month and county from Commercial Fertilizer Database compiled by Association of American Plant Food Control Officials & The Fertilizer Institute for 10 fertilizer types.
  - Emissions depend on many factors including
    - Temperature, Moisture
    - Fertilizer Type
    - Method of Application (injection vs. broadcast)
- **Missing from EI:** Organic fertilizer (animal waste)

Ammonia From Point Sources

(fertilizer production, refineries, POTW's, refrigeration)

- **Point sources** - Significant local contributors?
- **NET estimates** - Largely based upon 1985 NAPAP inventory projected to present using economic growth data at state/SIC level. Small amount of 1996 point source data now in NET.
- **Inconsistencies** - Emission sources with same SCC may not be estimated consistently across states
- **Near Term Project:** compare categories and sources across NET for gaps and logical inconsistencies, then target state efforts.

Features Needed to Estimate NH3 Emissions for Regional Scale Analyses

- **Spatial Resolution for Modeling EI**
  - "Small County" - we can allocate to Grid
  - NOT "Farm" or "Process" Level
- **Temporal Resolution for Modeling EI**
  - Emissions processor - May eventually need to apply short-term meteorological variables (e.g., Temp, Precip, RH) to estimate emissions

Ammonia Activities

- **Recent Development -** Workshop conducted by USDA, EPA to discuss conceptual framework of Ammonia Emissions Estimation
- **EPA CAFO Project -** (EPA/ESD in progress)
- **CMU EI Project -** develop National top-down ammonia inventory (Sponsored by MARAMA - in progress)
- **Needed -** National database on crop type, with typical application schedules, rates by crops, and application practices would improve estimates

Where the Research is Heading:

- Process-level algorithms relating emissions to process variables that can be easily measured or estimated.
- Field validation of the algorithms
- Software that interfaces with our AQ Transport and Transformation Models
- What is sensitivity of Model to NH3 EI?